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A. Significance

A.1 Absolute Priority, “Promoting Evidence-Based Literacy, aligned with national efforts to improve literacy achievement nationwide.”

Enable Middle-Graders with Powerful Reading Comprehension (**EMPOWER**) is an **Expansion grant** that will evaluate and scale the knowledge acquisition and transformation (KAT) framework, an evidence-based reading comprehension program, to socioeconomically disadvantaged (i.e., eligible for a free or reduced-price lunch) middle-grade students in grades 6, 7, and 8 in Arkansas, Arizona, Oklahoma, Texas, and Utah schools. EMPOWER promotes evidence-based KAT reading comprehension instruction consistent with the science of reading and reported in the What Works Clearinghouse Practice Guide (2022). This project will **rigorously evaluate the scalability of four KAT components in multiple states and expanded grade levels**: (1) KAT-Practice-based professional development (**KAT-PBPD**), (2) KAT-360 degree supports for implementation and sustainability (**KAT-360**), (3) KAT teacher lessons delivered to students (**KAT-Teacher**), and (4) KAT implemented in the web-based Intelligent Tutoring for the Structure Strategy (**ITSS**). These solutions are leading-edge **innovations to address the four root causes of reading comprehension problems** in middle grades, which **pose barriers to scaling**. Through an EMPOWER randomized controlled trial (RCT) involving 72 schools (216 teachers departmentalized, 16,200 students), gathering evidence will help establish the impact of the components and inform guidelines and recommendations for efficiently and effectively scaling up in grades 6-8 across **five states**.

This proposal is submitted by the Literacy.IO team at the Texas A&M University Research Foundation (TAMURF), in collaboration with technology platform partner Problem Solutions Inc., and a Practitioner-Led Advisory Board comprising Teacher Ambassadors from partner states. Our external evaluation team is led by the Tennessee Reading Research Center (TRRC)

and Analytica Insights, Inc.

EMPOWER will promote reading comprehension, an essential skill in middle grades for students in 72 socioeconomically disadvantaged schools in five states. Twenty-four schools each year (organized into three cohorts: Years 1-2, 2-3, and 3-4) will participate in the RCT evaluation of the four EMPOWER components. Reading proficiency in the first cohort of 24 schools is presented in Table 1, with the number of students who will be served in Year 1.

Letters of support from these schools are in Appendix C. Upon completion of the evaluation, the project will have delivered evidence-based reading comprehension instruction to **over 16,200 middle school students in five states** (Table 1).

Table 1. Percent 7th Graders Scoring Reading Proficient in 24 Schools in Year 1 Cohort

State	7 th Grade Proficient	Total 7 th Grade Students	State	7 th Grade Proficient	Total 7 th Grade Students
Arkansas	20%	500	Arizona	29%	600
Texas	50%	3,000	Oklahoma	36%	800
Utah	50%	500	-	-	-



A.2 Prior Evidence

There is Strong Evidence from two trusted scientific sources for KAT implemented in ITSS.

First, the What Works Clearinghouse (WWC) published an Intervention Report reviewing three cluster RCTs on ITSS (████████████████████); WWC ITSS Intervention Report, 2020). This report classifies ITSS as **Meets Evidence Standards Without Reservations, which is the highest evidence for Reading Comprehension**. ITSS has strong evidence with positive and statistically significant effects on reading comprehension for students at grades 4, 5, and 7. Second, KAT uses the WWC Practice Guide “Providing Reading Interventions for Students in Grades 4-9” Recommendation #3C, “Teach students how to use text structures to generate gist statements” (p. 12, WWC 2022)

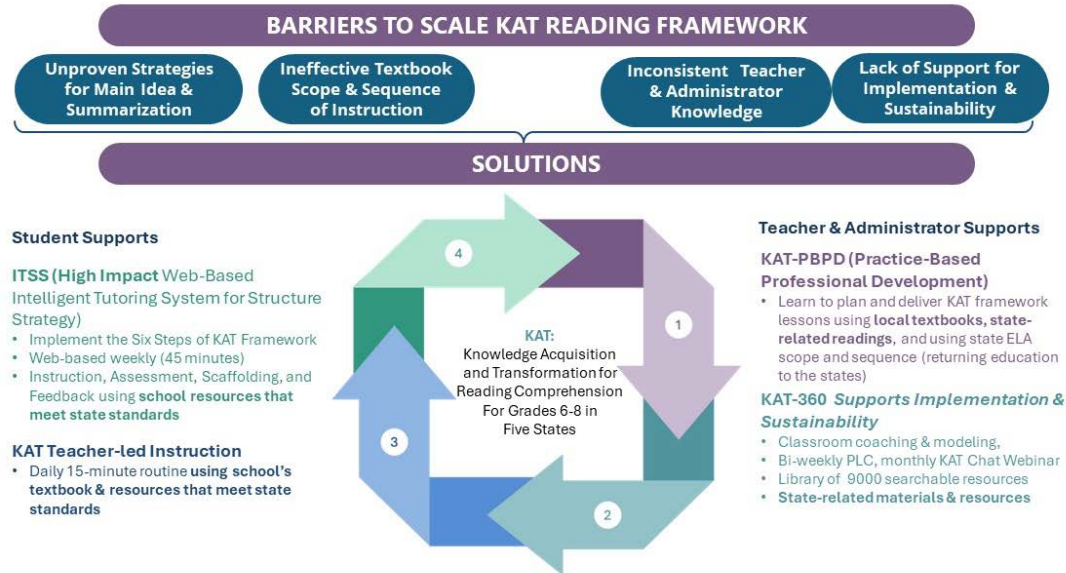
A.3 Innovation

EMPOWER’s innovative approach includes **high-quality web-based instructional solutions for students (ITSS) and teachers (KAT-PBPD)**, updating the **KAT-360** resources for use with students and teachers in grades 6-8. **Additionally, it involves developing web-based state-related lesson plans to serve socioeconomically disadvantaged middle-grade students in five states (KAT-360)**. The project will also explore the combined effects of the four components in a three-cohort design RCT to determine impact, cost, and establish guidelines for scaling.

Field-Initiated Innovations—EMPOWER components were developed by teachers and administrators for teachers and administrators and achieved 100% pass rates on the state assessment of elementary students’ reading proficiency from 2016-2024 at Keller Elementary School (see  [Video](#)). The causes for the reading comprehension problems (i.e., barriers to scale) were identified through multiple implementations of the KAT framework in these and other elementary schools (). *The barriers are: (a) non-evidence-based strategies for main idea and summarization skills, (b) ineffective textbook scope and sequence, (c) inconsistent teacher and administrator knowledge, and (d) lack of support for reading instruction, based on science of reading principles, implementation, and sustainability.* EMPOWER will address these barriers using practical, teacher-initiated resources and web-based tools. **We will rigorously evaluate and report on how EMPOWER’s four components alleviate the barriers to scale and present a strong, scalable solution to the persistent reading comprehension problems of middle-grade students. ITSS, KAT-Teacher lessons, KAT-PBPD, and KAT-360** can reach students and teachers in wide geographic regions and provide high-quality, consistent, and school-selected reading lessons aligned to state needs, standards, and grounded in the science of reading. The web-based, **field-initiated** tools in EMPOWER significantly **reduce the costs of delivery, data collection, formative and**

summative assessment, and provide flexible, efficient, and effective research administration and dissemination capabilities.

Figure 1: EMPOWER Addresses Four Barriers to Scale with Strong Scalable Solutions



Competitive Preference Priority 1 – Returning education to the states. This proposal is a strong partnership among the Texas land grant institution, Texas A&M University's Research Foundation (TAMRF), and **five state education agencies** from Arkansas, Arizona, Oklahoma, Texas, and Utah, that serve populations where over 80% of children are eligible for a free or reduced-price lunch. The external evaluator is a **state-funded**, prestigious Center in Tennessee that studies the effectiveness of reading interventions and has become a national resource for strong evidence. EMPOWER's four components will be adapted to meet the school's needs, which are aligned with **state standards**. The KAT Teacher lessons (Appendix J:Exhibit J2) will be developed for local textbooks and resources. The KAT-PBPD and KAT-360 resources will use these local textbooks and resources for training purposes. We will develop new ITSS lessons using local textbooks that meet current state standards.

Competitive Preference Priority 2 – EMPOWER uses the two high-impact web-based AI

tutoring systems that **accelerate learning** for middle-grade students (ITSS) and their teachers (KAT-PBPD). ITSS is the web-based AI tool for students showing transformative results and featured in the WWC (WWC, 2020; [REDACTED]). The KAT-PBPD is AI-driven, individualized, and accelerates high-impact outcomes for teachers ([REDACTED]). Teacher and administrator knowledge of reading comprehension instruction, aligned with the science of reading (SOR), was predictive of large improvements in the recent research study with upper elementary schools (Hudson et al., 2023, [REDACTED]). Consequently, using powerful web-based KAT-PBPD is likely to increase teacher and administrator knowledge and practice, resulting in improved learning and outcomes for students.

B. Strategy to Scale

B.1 Unmet Demand

Reading comprehension promotes academic and professional success, economic security, health, mental health and wellness, and civic engagement (Kutner et al., 2022, Lyon, 2001). Addressing the lack of reading comprehension in middle grades becomes an urgent crisis that, if not addressed, will lead to life-altering consequences for the student and communities. Reading plays a vital role in middle grades, where students **read to learn** subject areas, such as science and history/social studies, and complete low- and high-stakes assessments (Reardon, 2012; Shanahan & Shanahan, 2012; Sparks et al., 2013). A science test requires students to read the question descriptions and select the best answer choices. Middle grades are pivotal in student success in progressing towards high school or dropping out (Bowers et al., 2013; Fang, 2006; Sanford & Horner, 2013). Reading challenges from elementary school often worsen in middle grades, where students must handle more complex texts with advanced academic vocabulary.

The proposed EMPOWER is especially timely given the 2024 NAEP results, which show that reading scores declined nationally in both 4th and 8th grades, with 33% of 8th graders

performing below the NAEP Basic level. This is the highest percentage ever recorded. These alarming findings underscore the urgent need for effective, scalable reading interventions, aligned with state standards and grounded in SOR, targeting middle-grade students.

Why are so many children failing comprehension?

Skilled readers gather information from the text, logically connect the ideas, and store them in long-term memory (Kintsch & van Dijk, 1978). Reading theories, such as the construction integration model by Kintsch, and cognitive empirical evidence (Meyer et al., 2010; ██████████ ██████████) show that: 1) generating a main idea is an efficient and effective mental anchor for storing information in long-term memory; 2) expanding the main idea with supporting details to create a summary strengthen and reinforces long-term memory; and 3) leveraging the summary to extend logical connections fosters inferences, identifying what the author did not explicitly state, further solidifying long-term memory storage.

Figure 2: Main Idea Challenge

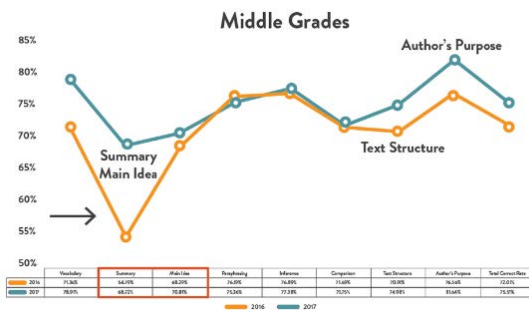


Figure 3: Main Idea with Text Structures

Cause is _____ the effects are _____. _____. _____. _____.
 Problem is _____ the solution is _____
 Cause is _____, problem is _____ solution is _____
 Comparison:
 _____ and _____ were compared on _____, _____, and _____

Analysis of middle-grade reading comprehension data reveals a **critical 'comprehension danger zone'** where students consistently struggle with generating main ideas, creating summaries, and making inferences. As illustrated in Figure 2 (██████████), student proficiency in summarizing and identifying main ideas is notably low, often below 60%. The cumulative effect of these deficits presents significant comprehension challenges across English Language Arts, science, and social studies. **Crucially, proficiency in these three**

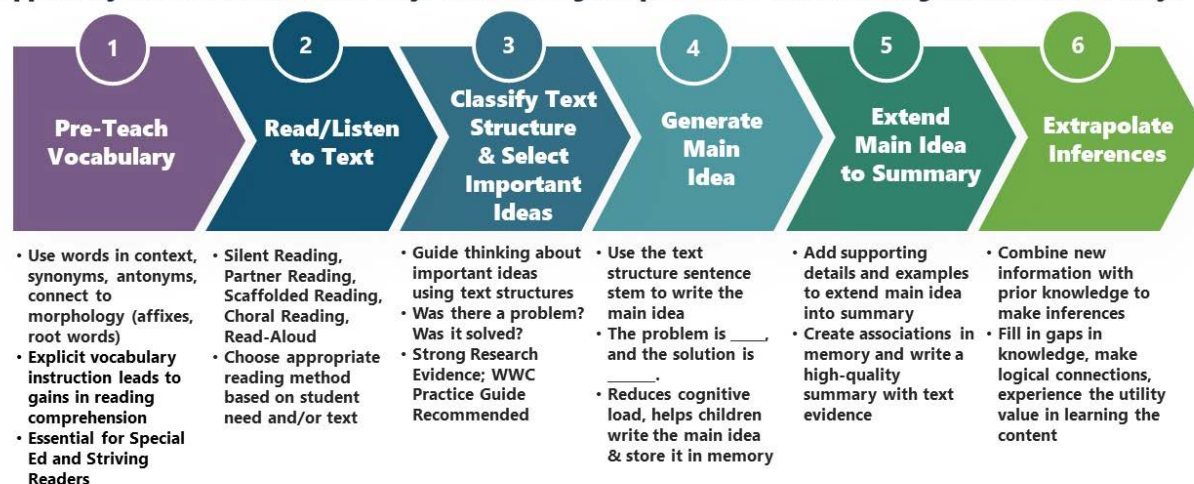
interdependent skills is measured in every high-stakes reading assessment—including state assessments—as the primary gauge of comprehension. Therefore, robust and explicit instruction in these essential comprehension skills is vital for every middle-grade student.

It is important to use evidence-based strategies to teach middle-grade students how to generate main ideas (i.e., gist or central idea), summaries, and inferences. EMPOWER leverages the **six-step** KAT framework (see Figures 3 and 4) to help students learn how to generate the main idea of a passage, add important details to create an accurate summary, and use clues from the passage and their own background to infer what is not explicitly stated (but is implied). Teaching students how to generate main ideas, summaries, and inferences efficiently and effectively using **text structures** has proven successful for students in previous research (Boegards-Hazenberg, 2021; Hebert et al., 2016) and is an evidence-based recommendation in the WWC Practice Guide (WWC, 2022). This evidence has been accumulated since 1975 (Meyer, 1975) and continues today. Recent research on text-structure use in elementary and middle schools shows strong and positive findings ([REDACTED]).

Although 50+ years of research have demonstrated that the **KAT framework components** yield strong outcomes for reading comprehension in grades K through 12, these **solutions have not been widely adopted or scaled broadly**. Recent research on implementation science and our experience delivering the KAT components in schools during the past decade illustrate the **root causes for the lack of scalability** (Beerwinkle et al., 2018; [REDACTED]). Studies of the school systems' contexts in multiple states, such as Texas, Arkansas, and Arizona, found that **unproven strategies without evidence of effectiveness were being used in 100% of the classrooms**, and the **textbook's scope and sequence spiraled through all reading standards equally** (Beerwinkle et al., 2018). Main ideas, summaries, and inferences were **not** prioritized

and were **not** taught with evidence-based strategies. Both unproven strategies without evidence of effectiveness and arbitrary spiraling of skills result in poor reading outcomes for the students. Finally, research on **teacher and administrator content and pedagogical knowledge on building student reading comprehension skills** reports that most did not know or use evidence-based strategies, and they (in addition to their students) had difficulties generating the main idea of a text ([REDACTED]).

Figure 4: KAT Reading Framework Uses Text Structures to Solve the Reading Problems
Six Steps of the KAT Reading Framework
Applied by Teacher (15 Minutes Daily) and ITSS High Impact Web-Based Tutoring (45 Minutes Weekly)



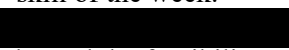
Demand for scaling of the KAT framework is met by EMPOWER’s four components. The infrastructure and components were developed, deployed, refined, and rigorously and iteratively tested in multiple randomized controlled trials with embedded and complementary implementation and impact studies (see [REDACTED], [REDACTED], US Dept of Education Grants R305A150057, R305A180060; U423A180073).

The most recent EIR (KATE – S411A210002) studied the impact of the four components at grades 3-5, and preliminary results show large positive effects on teacher outcomes ([REDACTED]) and student outcomes (First Thursday <https://tinyurl.com/ZessinsMastery>). We present letters of support for EMPOWER Cohort 1 from the same schools that achieved

great success in the elementary grades (Arizona Charter Academy, Klein Independent School District, North Little Rock School District, Brownsville Independent School District, Harlingen Consolidated School District, Ponca City School District, College Station Independent School District). These schools are all eager to participate and scale the KAT framework to their middle grades based on their positive experiences at their elementary schools. **Scaling EMPOWER components are in high demand and likely to produce similar results at the middle grades.**

Appendix J: Table J1 presents video and text testimonials from practitioners in multiple states participating in the current EIR KATE grant. Table 2 presents the causes for the reading problems and short descriptions of our solutions.

Table 2: Barriers to Scale KAT and Rationale for Solutions

Barrier	Solution with Evidence	Scalability of Innovation
Unproven Strategies	The KAT framework uses the text structure to select important ideas, write a main idea with text structure sentence stems, extend it to a summary with evidence from the text, and generate inferences. (WWC Practice Guide, 2022; Boegards-Hazenberg, 2021; Herbert et al., 2016)	<ul style="list-style-type: none"> • <i>NEW KAT lesson guides will be created by TAMURF team members and reviewed by the state teacher ambassadors and placed in the KAT360 library.</i> • The KAT lesson guides promote the main idea, summary, and inference for all <i>local and state textbook</i> passages, popular storybooks, science, and social studies texts. All genres of text: narrative, expository, poetry, and biography are covered. • Scalability is improved by KAT lesson guides that are available on the web-based KAT360 searchable library and used in the KAT teacher lesson, 15 minutes daily. • <i>NEW ITSS lessons will be created by the TAMURF technology team for local textbooks for student use (45 minutes weekly).</i> • Teachers and administrators learn how to create their own KAT lesson guides during PBDP.
Ineffective Textbook Scope & Sequence	The KAT lesson guide embodies the necessary classroom instruction to precede the textbook's "skill of the week."  showed the feasibility and efficacy of this solution with large effects on main idea competency at elementary grades and some middle school	<ul style="list-style-type: none"> • The KAT main idea, summary, and inference instruction using the KAT lesson guide takes 15-20 minutes daily, devoting the rest of the instructional time for other skills such as author's purpose, character traits, etc. • The other skills leverage the main idea to help learning. • Over 9000+ resources with KAT lesson guides, videos, and PPTs have been created. <i>EMPOWER will create more resources for middle-grade ELA, Science, Social Studies in all genres – narrative, expository, poetry, and biography.</i> • <i>New middle-grades HMH, Wit&Wisdom, Amplify, SAVAS, and textbook KAT Guides will be created by</i>

	classrooms	<i>TAMURF and reviewed by state Teacher Ambassadors and placed in the KAT360 Library</i>
Inconsistent Teacher and Admin Knowledge	Teacher and administrator knowledge is proven to be very important to student success (DeSimone, 2023; Hudson et al., 2023; [REDACTED]) Teacher pedagogical and content knowledge can be improved through PBPB ([REDACTED])	<ul style="list-style-type: none"> Strong KAT-PBPD is available using web-based and face-to-face delivery in synchronous and asynchronous modes. This approach presents a powerful, scalable approach to reach geographically dispersed audiences. These tools were created using a recent SEED grant and proved to be very successful in reaching over 9000 educators (Hudson et al., 2023; [REDACTED]; [REDACTED]) Two days of PBPB (see Agenda in Appendix J: Table J2) cover theory, problems with current practices, solutions, and practice on developing KAT lesson guides for narrative, expository, poetry, and biography texts. PBPB has an applied component with practice on delivering KAT lessons with feedback from expert teachers.
Lack of support for implementation (fidelity) and sustainability.	Coaching and modeling, PLCs, and administrator support have empirical evidence in improving student outcomes. (Schachter et al. 2025; Walpole & Blamey, 2008)	<ul style="list-style-type: none"> KAT360 includes structured PLC meetings negotiated during onboarding. Coaches and principals train with the teachers and receive additional training on using the Literacy-iCoach App for fidelity walkthroughs. The KAT360 library of 9000+ resources is used by all personnel regularly. The monthly KAT-Chat webinar is attended by all (and the accompanying newsletter is reviewed during PLC).

Table 3: Goals, Objectives, Timeline, and Teams

Goals, Objectives, Milestones, Timeline & Personnel	YR1			YR2			YR3			YR4			YR5			Team
	W	S	F	W	S	F	W	S	F	W	S	F	W	S	F	
Goal 1: Recruit and Onboard Schools and Create New KAT Resources for School Textbooks and State Standards for Grades 6-8 in Five States																
Objective 1: Recruit & Onboard schools and gather school data & practices																
1.1 Recruit schools (Cohort 1 complete) for Cohorts 2 and 3	c1			c2			c3									1,4
1.2 Gather and Review Textbooks and School Level ELA Resources	c1	c1		c2	c2		c3	c3								1,3
1.3 Gather school-level 5-year student reading outcome data by construct	c1	c1		c2	c2		c3	c3								1,3
1.4 Gather and analyze teacher & administrator knowledge (Pre, post, 1yr)	c1	c1		c2	c2		c3	c3								1,4
1.5 Plan & develop new lessons for the Textbooks and School Resources	c1	c1	c1	c2	c2	c2	c3	c3	c3	c3	✓	✓	✓			1,3
1.6 Create accompanying ITSS Lessons	c1	c1	c1	c2	c2	c2	c3	c3	c3	c3	✓	✓	✓			1,4
Objective 2: Validate materials - State Teacher Ambassadors	c1			c2			c3				✓	✓	✓	✓	✓	2
Goal 2: Determine Impact, Cost, and Scalability Factors of EMPOWER Components																
Objective 3: Establish Impact Estimates Using an RCT																
3.1 Randomize Schools and Deliver PBPB for teachers and administrators		c1		c2			c3									4,3,1
3.2 Secure roster uploads and school set-up		c1		c2			c3									3
3.3 Collect data with students (Pre and Post)		c1	c1	c2	c2		c3	c3								1,3,4
3.4 Implement KAT teacher instruction 15 minutes daily		c1	c1	c2	c2	c2	c3	c3	c3							1
3.5 Implement ITSS 45 minutes weekly		c1	c1	c2	c2	c2	c3	c3	c3							3
3.6 Clean & Analyze data, prepare dissemination materials, disseminate				c1	c1		c2	c2		c3	c3	✓	✓	✓	✓	4,1,3
Objective 4: Monitor and Analyze Fidelity of Implementation																
4.1 Coach and principal iCoach app training		c1	c1	c2	c2		c3	c3								1,3
4.2 Coach and principal walkthroughs and monitoring (iCoachApp)		c1	c1	c2	c2	c2	c3	c3	c3							1
4.3 Observations conducted by TAMRF and TRRC & KAT360		c1	c1	c2	c2	c2	c3	c3	c3							1,3,4
4.4 Usage metrics ITSS, PLC, KAT360		c1	c1	c2	c2	c2	c3	c3	c3			✓	✓			3
Objective 5: Conduct Cost Analysis - Calculate Cost Using Ingredients Methods																
5.1 Calculate Costs for EMPOWER				c1			c2			c3	✓	✓				4
Objective 6: Determine Scalability Factors - Correlate teacher knowledge and teacher fidelity to student outcomes.																
6.1 Prepare prescriptive roadmap for success with thresholds for fidelity and outcomes												✓	✓	✓	✓	1,4
6.2 Finalize KAT360, Validate Resources, Disseminate												✓	✓	✓	✓	1,2,3
<i>Team 1 - Development & School Engagement Team, Team 2 - Teacher Ambassadors - Expert Practitioners from five states, Team 3 - Technology Platform Support, Team 4 - Independent Evaluation Team; c1 = Cohort 1, c2 = Cohort 2, c3 = Cohort 3.</i>																

B.2 EMPOWER management plan to achieve the objectives on time and within budget

Table 3 presents the Goals, Objectives, Timeline, and Teams working together to complete the project successfully and under budget. The EMPOWER management team, led by [REDACTED], [REDACTED], and [REDACTED] have each successfully completed over 10 high-quality grants and RCTs. Four teams will collaborate to complete this EMPOWER project. The personnel diagram captures our management structure, goals, personnel, roles, and responsibilities. Appendix J: Figure J1 displays the teams and coordination of activities.

B.3 EMPOWER Partner Commitment

Team personnel, management capacity, and financial resources

Our team includes experienced researchers, practitioners, technology experts, and methodologists from the Literacy.IO team at TAMURF ([REDACTED]), Analytica Insights ([REDACTED]), and Problem Solutions ([REDACTED]). These partners have successfully collaborated on multiple projects, including a current EIR Expansion KATE grant. The independent evaluation team is the Tennessee Reading Research Center (TRRC; [REDACTED] and [REDACTED]), lending their expertise to ensure a high-quality project and independence in reporting the outcomes. There are four teams to successfully manage this EMPOWER project to improve reading and complete it in a fiscally efficient and effective manner. Each member will devote sufficient time to accomplish the tasks. Their roles and time commitments are described by our goals below. **Team 1** is comprised of experts from TAMURF and led by [REDACTED]. The experts include [REDACTED], [REDACTED], [REDACTED], [REDACTED], [REDACTED], [REDACTED], [REDACTED], [REDACTED], and [REDACTED]. **Team 2** is the Teacher Ambassador team has eight teachers from our states. They have all achieved 100% pass rates on state reading proficiency through KAT instruction. [REDACTED] from Utah will serve as a school lead and disseminate quarterly podcasts about the EMPOWER project. **Team 3** is the Problem Solutions programmers and designers (5) who work full time on

supporting all the efforts of this EMPOWER project. **Team 4** is the external evaluators from TRRC (█████ lead) and Analytica Insights (█████). Appendix J: Exhibit J1 and Figure J1 present details about the team, their expertise, and time commitment to successfully complete the grant.

Goal 1: Recruit and Onboard Schools and Create New KAT Resources for School

Textbooks and State Standards for Grades 6-8 in Five States

Personnel: ██████ 2 months, ██████ 3 months, ██████ 3 months, ██████ 3 months, ██████ 1 month, ██████ 4 months, ██████ 3 months. State Teacher Ambassadors 3 days, Problem Solutions 5 programmers and designers 5 months, TRRC 5 experts devote 3 weeks each, and Analytica Insights expert 2 months.

█████ has architected, developed, and refined all the EMPOWER modules since 2000. She is a programmer and teacher with extensive classroom experience. ██████, ██████, and ██████ have recruited over 60 schools in the most recent EIR project. ██████, ██████, ██████, and ██████ have conducted lesson design activities at upper elementary grades and middle schools from 2018 to 2025 in the Elementary EIR KATE grant and SEED grant. They have 22+ years of teaching experience and achieved 100% pass rates in their classrooms before joining the TAMURF team. ██████ served as the Principal of Keller Elementary School in Brownsville, TX, and was the *first to achieve 100% pass rates* on state reading proficiency and sustained it over 9 years. ██████ is a programmer and has developed over 400 ITSS lessons. She has worked on the KAT projects for 18 years. ██████ is a graphic designer and has created over 500 videos and resources for ITSS and KAT since 2010. The team will be assisted by the Problem Solutions programming team. Teacher Ambassadors from each state will review new content for suitability for the local and state context. ██████ (AR), ██████ (TX), ██████ (TX), ██████ (UT), ██████ (TX), ██████ (AZ), and ██████

██████████ (TX). These Ambassadors have showcased their work in the KAT-Chat webinars, presented at PBPD sessions, and earned multiple credentials through the recently completed SEED-PBPD grant U412A180074. Appendix J: Table J1 presents links to Ambassador success videos. Evaluators ██████████ and ██████████ have strong 20+ years of experience in conducting random assignment, gathering information about the EMPOWER content & designing RCTs that meet WWC standards.

Goal 2: Determine Impact, Cost, and Scalability Factors of EMPOWER Components

██████████ 2 months, ██████████ (1 month), ██████████ (1 month), ██████████ (1 month, ██████████ 9 months, ██████████ 9 months, ██████████ 9 months, ██████████ 3 months, ██████████ 9 months, ██████████ 9 months, State Teacher Ambassadors 9 days, Problem Solutions 5 programmers and designers 9 months, TRRC 5 experts 4 months.

██████████ has conducted 10 RCTs in literacy and mathematics that meet WWC standards. Her two RCTs conducted in grades 4 and 7 have met WWC standards without reservations (██████████; ██████████). She has successfully recruited over 1000 schools for these projects nationwide and trained over 9000 teachers with the SEED funding. She is a featured speaker at most practitioner conferences, including The Reading League and the International Dyslexia Association. She will manage the entire project. She will be assisted by ██████████ and ██████████, who will train the observers, train personnel on data collection, and assist with KAT-PBPD delivery. They each have over 20 years of experience in literacy instruction and research. They were partners in the current EIR-KATE grant. ██████████ ██████████ is a strong methodologist with multiple NSF grants and will supervise data cleaning, and review progress. ██████████, ██████████, ██████████, and ██████████ have excellent experiences in conducting three different RCTs and the most recent EIR-KATE RCTs. They deliver KAT-

PBPD, conduct classroom coaching and modeling, conduct fidelity observations, support PLCs, and deliver the monthly KAT-Chat webinars. [REDACTED] has managed the entire ITSS software system and manages all the school roster uploads, monitoring testing, working closely with the Problem Solutions programmers to scale up and down the AWS web services as needed. She also runs reports and generates data files regularly. [REDACTED] continuously updates the videos and resources in the KAT360 Library. **Team 1** has successfully conducted all these efforts in the current EIR-KATE (S411A210002) project from 2022 to 2025, and has sustained strong, trusted relationships with school personnel, as evidenced by their continuing interest in bringing EMPOWER to middle grades. State teacher ambassadors are experienced 100% pass rate experts who will deliver model lessons during KAT-PBPD and assist in review state standards. **TRRC and Analytica Insights** experts will conduct their own classroom observations. [REDACTED] will work closely with the teams to ensure WWC standards alignment, conduct the cost analysis, and review the design, implementation fidelity, analytics, and reporting.

Teams 1, 2, and 3 will prepare the Roadmaps for Success based on data analysis reported by **Team 4**. The dissemination of findings and preparation of the middle grades textbook will be completed by [REDACTED], [REDACTED], and [REDACTED], as they did for the Joy of Reading El. Textbook, which they published based on the current EIR KATE grant findings.

The financial resources of all the participating organizations are stable and supportive of this EMPOWER project with matching funds and resources. PI [REDACTED] is the [REDACTED] [REDACTED] at TAMU and holds two endowments that provide the match and additional financial resources for the project. The partner institutions each have infrastructures for collaboration, already conduct conferences and outreach to schools and policy-makers (e.g. TRRC support from the Tennessee Department of Education), and have the

financial resources to manage the finances related to EMPOWER.

B.4 Plan to Deliver EMPOWER Services More Efficiently at Scale

TAMURF has a track record of success in developing, deploying, and sustaining the KAT solutions to over 9,000 teachers nationwide. These tools were developed through a SEED grant (U423A180074) and further refined through the recent EIR KATE grant (S411A210002) for upper elementary schools. The web-based tools are hosted on an AWS cloud platform that delivers the KAT-PBPD, KAT-360's 9000+ resources (e.g., KAT Teacher lesson guides, KAT Teacher modeling videos, instructional resources such as posters and bookmarks), and ITSS individualized high-impact tutoring to accelerate learning for students. The AWS platform is available 24/7, scalable based on the number of users (e.g., more cores when testing), and provides access to all resources. The KAT-360 system also uses SWVL devices and ZOOM to collaborate on PLC meetings (e.g., TAMURF team member to attend multiple PLC meetings bi-weekly), conduct classroom observations, and deliver the monthly KAT-Chat Webinar. During the KAT-Chat Webinar, teachers share their experiences, model lessons are presented to suit state needs, and the event is recorded and saved to the KAT360 Library for ease of viewing.

The EMPOWER scale-up requires pre- and post-testing for students. The ITSS platform has already been modified and extended to accommodate all testing for the standardized and researcher-designed measures. All scoring is done using natural language processing (NLP) and AI tools to check for misspellings, synonyms, and idea units in student responses.

The PBPD is fully available on the web using a massively open online virtual learning system where instructional videos are presented to teachers, interactive learning activities are completed, and KAT lesson planning is practiced. A survey of teacher knowledge and practices is also administered on this platform.

The fidelity observations in EMPOWER use an easy-to-use and scalable iCoach and iTeach App (Appendix J: Exhibit J3). This is available on both the Android and Apple platforms. The iCoach App is used by the coaches and administrators during walkthroughs and the TAMURF and TRRC evaluation teams to complete fidelity observations. These observations automatically generate constructive feedback to the teachers and coaches and present an efficient scalable solution for fidelity.

Finally, the School Onboarding tools enable the mining of student longitudinal data and the knowledge and practices of teachers and administrators. The system creates prescriptive recommendations for recommended activities on the KAT-PBPD and KAT-360 videos.

The powerful technologies supporting the four EMPOWER components allow the team to scale this intervention effectively and efficiently. More importantly, the compilation of the resources (e.g., state-level lesson plans and KAT-Teacher Lesson Guides for eight textbook series) creates a sustainable solution that can be further disseminated to more schools. As teachers in different regions share their own KAT-Teacher Lesson Guides, we review them and create a crowd-sourced, curated KAT-360 library.

B.5. Dissemination Plan

Our team has established groundbreaking, evidence-based efforts to transform reading comprehension, translate these findings for practitioner use, produce resources that can be directly used in schools, and make them all widely available on multiple platforms, such as online lesson plans, videos, games, podcasts on all free platforms, and newsletters. Appendix J: Table J3 presents a detailed matrix showing the currently available Library resources. During the EMPOWER project we will extend these customized and curated resources to middle grades.

The following are samples of resources that will be extended to middle grades through

EMPOWER: **KAT-360** (led by [REDACTED], [REDACTED], and [REDACTED]) presents on-demand diagnostics of teacher and administrator content and pedagogical knowledge, and recommended study modules in the KAT-PBPD. Resources include hundreds of sample teacher videos, “how-to” guides, and classroom use materials (e.g., bookmarks, posters, games, lesson PPTs – see Appendix J: Table J3). [Monthly KAT Chat Webinar](#) for middle grades with Newsletter showing the power of teachers encouraging peers through their transformational implementation of EMPOWER (led by [REDACTED] & [REDACTED]). **KAT-360 Teacher Library** (led by [REDACTED]). We will plan **Annual conferences** (led by [REDACTED], [REDACTED]), such as CUSP-sponsored events since 2017, which have been held in regional locations and on Zoom. **Social Media** (led by [REDACTED] & [REDACTED], [REDACTED]-TRRC), including Facebook, Twitter, and Instagram. **Podcasts** (led by [REDACTED], [REDACTED]) on six free platforms for schools and families to learn how to apply the KAT strategies to improve comprehension. [REDACTED] from Utah will also deliver a quarterly “**Teaching Literacy Podcast**” on EMPOWER. He currently has over 100,000 followers on social media. **Policy briefs** for policy-makers (led by [REDACTED], [REDACTED], [REDACTED]). **Presentations at conferences and publications** (led by [REDACTED], [REDACTED], [REDACTED], [REDACTED]) in high-quality researcher and practitioner journals. Finally, we have written and published the [REDACTED] for Grades 3-6 ([REDACTED]) based on the current EIR KATE grant. We anticipate doing the same for EMPOWER and produce a strong textbook for grades 6-8.

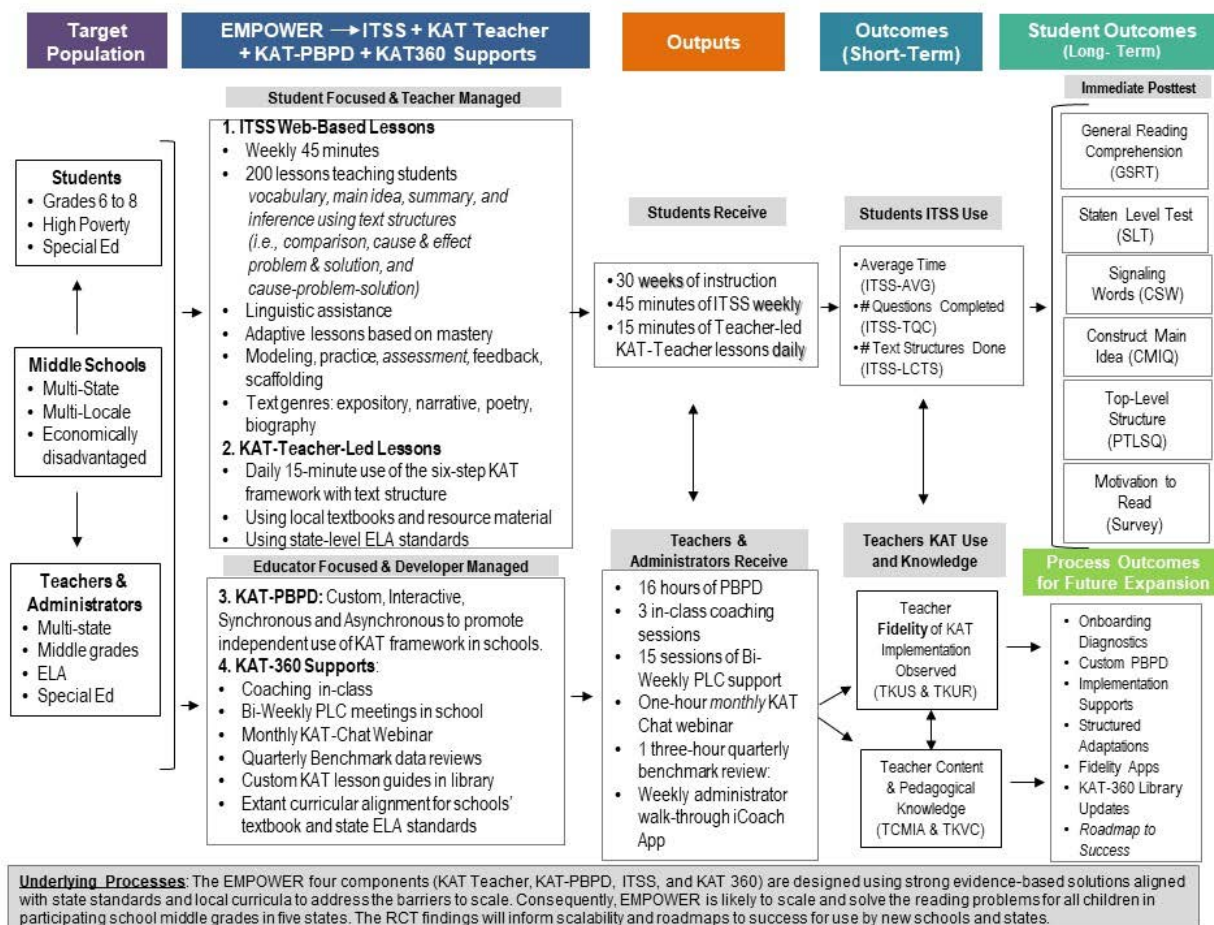
C. Quality of the EMPOWER Project Design

C.1 EMPOWER Logic Model

EMPOWER’s logic model (Figure 5 and Appendix G: Figure G1) aims to achieve positive reading comprehension outcomes for grade 6, 7, and 8 students. The model carefully maps the needs of both students and their teachers to several key components: **theory, evidence-based practices, PBPD, technology use, and supports to improve fidelity of implementation.**

Additionally, it includes **valid and reliable measures that inform both the implementation process and the estimation of impact**, as well as the mediation and moderation of outcomes derived from the research. These will help explain who benefits from this intervention and under what conditions the benefits apply.

Figure 5: Logic Model



Skilled readers carefully select important ideas while reading and generate a logical and coherent mental representation of the text (Bogaerds-Hazenberg et al., 2020; Shanahan, 2020, Vaughn et al., 2022). Multiple theories of reading explain how students read, generate a gist (i.e., main idea), extend the gist into a summary, integrate gist and supporting details into long-term memory, and apply knowledge to identify what is implied but not explicitly stated in text (e.g., make inferences). These theories include the Construction-Integration model (C-I, Kintsch & van

Dijk, 1978), the Landscape Model (Van den Broek et al., 1999; 2005), and Text Structure Model (Meyer 1975; [REDACTED]).

EMPOWER, with four KAT key components, relies on and supports the use of the text structure model to guide teacher instruction on developing student capabilities with vocabulary, main ideas, summaries, and inferences. Both theory and empirical evidence support the claim that students using the four KAT key components—with text structures as the central strategy for generating the main idea—improve reading comprehension compared to those who do not (WWC, 2022). [REDACTED] and Meyer and Poon (2001) identified “problem and solution,” “cause and effect,” and “comparison” as top-level structures (TLS) found across all genres of text, as they prompt students to engage in constructing higher-level, more meaningful schemata than simply listing facts (description structure) or ordering events (sequence structure).

Recent randomized controlled trials (RCTs) on ITSS (e.g., [REDACTED]; [REDACTED]) provide accumulating evidence that applying these TLS in classrooms results in positive reading comprehension outcomes on standardized tests and researcher-designed measures of main idea competence and TLS knowledge. Moreover, the previously mentioned and recently published WWC Practice Guide on reading interventions for grades 4-9, recommendation 3 emphasizes text structure strategies to grasp the gist of text (Vaughan et al, 2022)

The KAT-PBPD & KAT-360 platforms address the support for teachers and administrators to learn the strategies and use the resources to deliver evidence-based instruction to students in grades 6 to 8 (see Appendix J: Table J3). The supports include classroom coaching, weekly PLC, monthly KAT Chat webinars, and administrator walkthrough feedback.

C.2 EMPOWER goals, objectives, and outcomes are specified and measurable

EMPOWER's two major goals & anticipated outcomes are displayed in Table 4 as follows.

Table 4: Two Major Goals of EMPOWER and Anticipated Outcomes

Goal 1: Recruit and Onboard Schools and Create New KAT Resources for School Textbooks and State Standards for Grades 6-8 in Five States

Objectives & Lead	Activities & Lead	Measures of Progress
1. Recruit & Onboard schools and gather school data & practices	<ul style="list-style-type: none"> - For Cohorts 1, 2, and 3 TAMURF will recruit 24 schools. Cohort 1 recruitment is complete (see letters of support). For Cohorts 2 and 3 we will mail 1000 letters to schools from each state and follow up with phone calls to 200 schools. We will also recruit during presentations to regional educational service centers, the Reading League and IDA conferences each year. Using these techniques, this team has recruited over 60 schools for the current EIR grant. - Collect student data (5 years), teacher and administrator knowledge data, state scope and sequence, textbooks and resources used by schools. - Create KAT lesson guides and videos for reading lessons from five states' middle-grade ELA. - Create ITSS lessons with instruction, practice tasks, assessments, feedback, and scaffolding for 30 new lessons per state. - Update the web-based PBPD with examples from state-related content from middle grades 	<ul style="list-style-type: none"> • 24 schools sign MOU for participation in the study for each Cohort. • 20 textbook KAT lesson guides per grade level (60 total) per state • Ambassador feedback incorporated into KAT lesson guides • 10 state-level narrative and expository text KAT lesson guides prepared (50 total) • 150 lessons completed (30 per state) • PBPD lessons will contain state/textbook examples.
2. Validate materials by state Teacher Ambassadors	<ul style="list-style-type: none"> - Teacher Ambassadors review and suggest changes to KAT lessons. - Finalize KAT lesson guides for KAT-360 Library. 	60 lessons placed in KAT-360 Library
Goal 2: Determine EMPOWER Impact on Grade 6-8 Student Reading Outcomes, Cost, and Scalability Factors		
3. Establish impact estimates using a RCT	<ul style="list-style-type: none"> - Random assignment completed TRRC - Delivery PBPD - Data collection (TAMURF) - Teachers deliver KAT lesson daily for 15 minutes - ITSS delivers weekly 45-minute lesson 	<ul style="list-style-type: none"> • Random assignment by Cohort with baseline equivalence checked • Test all students from 24 schools, report attrition.
4. Monitor and Analyze Implementation Fidelity	<ul style="list-style-type: none"> - Classroom observations will be conducted by principals and coaches and recorded on the iCoach App creating a powerful scalable local solution. - Adherence fidelity observations (fall and spring) will be conducted in intervention and control schools by TRRC and TAMURF. Recorded on 	Compile fidelity scores for each teacher (24 schools x 3 grade levels departmentalized teachers = 72 per year teaching 5 classrooms of 15 students)

	iCoach App	
5. Calculate Costs	Ingredients approach (Analytica Insights)	Cost of EMPOWER components
6. Determine Scalability Factors - Correlate teacher knowledge and teacher fidelity to student outcomes	<ul style="list-style-type: none"> - Data cleaning is completed by TAMURF Team 1 and Team 3. Data analysis completed by TRRC Team 4. - TAMURF prepares Roadmaps for Success with fidelity scores in consultation with Team 4. - ITSS usage information by state correlated to student outcomes. 	<ul style="list-style-type: none"> • Effect size calculated for the student outcomes • Correlations reported • Roadmaps for 5 states and special education subgroups created

C.3 EMPOWER will ensure all objectives align with the EIR program's purpose

Literacy is the focus of EMPOWER. It aligns with “national efforts to improve literacy achievement nationwide”. We will serve students in grades 6-8 from socioeconomically disadvantaged communities in five states. These students require systematic and structured literacy instruction that is evidence-based, high-quality, and tailored to address their individual needs and the needs of their teachers. The four solutions together address the root cause of literacy problems and are practical, pragmatic solutions that were designed by teachers for teachers and have proven successful at upper elementary grades. **Scaling and extending the solutions to middle grades is likely to produce strong results for middle school students** who desperately need literacy assistance (see ITSS sample in Appendix J: Figure J2. Some unique supports in the ITSS and KAT-teacher lessons include:

1. Language supports for vocabulary and enhancing background knowledge about topics
2. Dyslexia and Special education and multi-lingual supports in ITSS (e.g. read the text aloud)
3. Instruction, practice tasks, scaffolding, and feedback for generating main ideas, summaries, and inferences (ITSS has over 400 lessons available and more will be created). We will create 200+ KAT-Teacher lessons for eight popular textbook series for middle grades.
4. Hundreds of lesson topics that are motivating to the learners through state-specific topics

D. Quality of the EMPOWER Project Evaluation

D.1. Evaluation is designed to meet WWC 5.0 standards without reservations.

TRRC, working with Analytica Insights Inc., will be the independent evaluator. In this role, TRRC will independently conduct random assignment and monitor implementation data collection for the RCT. TRRC will also independently analyze the pre- and post-test data (pooled across cohorts) and report findings. Analytica Insights has been a subcontractor on the WWC since its inception in 2002, was a Review Team Leadership member for a WWC Practice Guide and other products. The external evaluators will ensure the study is conducted to meet WWC Group Design Standards **without reservations and focused on research questions in Table 5.**

By design, EMPOWER will have a high probability of meeting WWC Standards for cluster studies (Figure 7 in WWC Handbook 5.0) without reservations for two primary reasons. First, the *outcome measures will be content-valid, psychometrically reliable, and aligned with the WWC's domains.* Second, the *attrition for schools, classrooms, and students will be low* because of a) strong incentives to participate, including the control group will be offered access to resources after the study ends for each cohort, b) monetary incentives for data collection in both groups and c) automated pre-and post-test data collection built into the ITSS web-based platform allows for real-time monitoring of student participation in both intervention and control. We will monitor daily pre- and posttest completion and check in with school coaches to promote completion of the tests in a timely manner. Students leaving the schools will be noted on their record. The current funded EIR-KATE (2022-25) project has recruited 54+ schools, completed school on-boarding, PBPD, student pre and post-testing with less than 5% differential attrition using these techniques. We will replicate the same efforts for this project.

If overall and differential attrition exceed WWC thresholds for low attrition, we will apply statistical controls to meet WWC standards. *Specifically, we will include pretest scores for each outcome as covariates in the analysis model and conduct a baseline equivalence test within*

the analysis sample. This test will confirm that the difference between the KAT and control groups does not exceed the WWC threshold of 0.25 standard deviations, required for valid statistical adjustment when baseline equivalence is not established through randomization alone.

In addition to meeting WWC standards, the TRRC team will conduct independent observations (in 25% of schools) to evaluate the *fidelity of KAT implementation*. Fidelity measures will include 1) 80% of teachers completing the six KAT steps during two observations; 2) 100% of teachers will attend at least 20 of the planned 30 PLC sessions in school.

Analytica Insights will conduct cost analyses of EMPOWER using the ingredients method applied to TAMURF’s administrative cost management system to identify all costs associated with the project, but not any costs associated with its evaluation (including data collection), to establish a replicable and sustainable model beyond the grant. The key ingredients include the opportunity cost of teacher and administrator time to participate in the KAT-PBPD and KAT-360 support programs, as well as the delivery of KAT Teacher daily instruction throughout the school year. Additionally, the opportunity cost of the time spent by the TAMURF team on KAT-PBPD to prepare teachers, and the cost of providing KAT-360 supports to assist teachers during the school year are also crucial components.

The impact evaluation of EMPOWER seeks to address the confirmatory and exploratory research questions about the impacts on student outcomes and teacher knowledge pooled across the three cohorts.

Table 5: Research Questions

EMPOWER’s Impact on Students
Primary Confirmatory Research Question
RQ1: Do grade 6 -8 students using EMPOWER components for one year outperform students in control schools on measures of reading comprehension?
Exploratory Research Questions
RQ2: Do grade 6 - 8 special education students using EMPOWER components for one year outperform special education students in control schools on measures of reading

comprehension? RQ3: Do grade 6 - 8 students using EMPOWER components for one year outperform students in control schools on measures of motivation to read, positive attitudes toward learning with computers, and/or structure strategy self-efficacy?
EMPOWER's Moderators to Establish Scalability Recommendations
RQ4: Do teacher characteristics (i.e., experience, certification type, grade level, amount of reading-related professional development, self-perception) at the start of the year predict teachers' score on a) main idea quality or b) fidelity of KAT implementation at the end of the year? RQ5: Do teachers' scores on the main idea quality, fidelity of KAT implementation, or ITSS fidelity predict students' reading comprehension outcomes at the end of the year separately or synergistically (i.e., combined)?
EMPOWER's Implementation Characteristics to Establish Scalability Recommendations
RQ6: What challenges are encountered during expansion, what conditions make implementation at scale more successful on student outcomes, and is the expansion cost-effective?

D.1.1 Sample and Statistical Power to Conduct Evaluation

We conducted a power analysis to determine the sample size needed to detect a meaningful impact on student reading comprehension. Our primary goal is to detect a minimum detectable effect size (MDES) of $d = 0.20$ (Kraft, 2020; Lortie-Forgues & Inglis, 2019). This target is ambitious yet realistic, informed by prior large-scale efficacy trials of the core instructional approach which found effect sizes ranging from 0.18 on standardized reading measures to 0.46 on researcher-designed measures (██████████). This target of $d = 0.20$ is also consistent with meta-analytic evidence for similar text structure interventions, especially experiments using standardized measures (Bogaerds-Hazenbergh et al., 2021, Hebert et al., 2016; Pyle et al., 2017) and reported by the WWC (WWC, 2020).

Using Optimal Design (OD; Spybrook et al., 2011) software for a multi-site cluster randomized trial, we based our calculations on intraclass correlations (ICCs) derived from our previous research with 7th grade students. As shown in Table 6, we considered two plausible ICC scenarios. Our final sample size targets are based on the classroom-level ICC of $\rho_{\text{level}2} = .16$ and a school-level ICC of $\rho_{\text{level}3} = .04$, as this combination most closely reflects the variance components observed in our prior efficacy studies using the same primary outcome measures

([REDACTED]).

Table 6. Power Analysis for 4-level Multi-Site CRT (alpha=.05)

Fixed effect				
	$\rho_{level2}=.16, \rho_{level3}=.04$		$\rho_{level2}=.13, \rho_{level3}=.09$	
	Schools	Sites	Schools	Sites
d=.20	56	14	92	23
d=.25	40	10	60	15
Random effect				
	$\rho_{level2}=.16, \rho_{level3}=.04$		$\rho_{level2}=.13, \rho_{level3}=.09$	
	Schools	Sites	Schools	Sites
d=.20	68	17	104	26
d=.25	48	12	72	18

1. Statistical power is .80.
2. Statistical significance level is $\alpha = .05$ for a two-tailed test.
3. Each classroom includes 20 students, but with a 25% attrition rate at posttest, such that 15 students per class will provide both pretest and posttest data.
4. Each school includes 10 classrooms.
5. Balanced allocation with two schools per experimental condition within each site.
6. Explanatory power (R^2) of school-level covariates is assumed to be 0 to be conservative.
7. Proportion of variance explained by the blocking variable is assumed to be 0 (conservative).
8. Intraclass correlation (ρ) values: $\rho_{level2}=.16, \rho_{level3}=.04$ and $\rho_{level2}=.13, \rho_{level3}=.09$.
9. Power analyses are presented for both fixed and random effects. For random effects analysis, we assumed effect size variance to be .01 across sites.
10. Minimum detectable effect size $d=.20$ or $.25$.

Note. Sites are groups of four schools with similar demographic characteristics.

This analysis indicates that to detect our target MDES of 0.20 with 80% power, we will need to recruit **56 schools (14 sites)** for a fixed-effects model or **68 schools (17 sites)** for a more conservative random-effects model. These estimates conservatively assume ten classrooms per school with 15 students providing complete data, an alpha of .05, and no variance explained by covariates. Because we will include powerful student-level pretest scores as covariates in our impact analyses, the statistical power will be even greater than these conservative estimates suggest (Raudenbush, 2002).

We are highly confident in our ability to meet, and even exceed, this recruitment target of 56 to 68 schools. **For example, as of this writing and the rate at which we are receiving enthusiastic letters of support, we expect to recruit 24 schools per cohort for a total of 72 schools.** This confidence is based on our proven track record of meeting or exceeding recruitment goals for IES and EIR grants, including the recent KATE grant; strong existing partnerships evidenced by letters of interest from 12 districts; regional education service centers, and a national outreach network supported by our new collaboration with the Tennessee Reading

Research Center, the Reading League, and Texas Rural Education Association.

D.1.2 Data Collection (on the web for rigor, efficiency, and ease of processing). All measures meet WWC standards for being reliable and valid (see Table 7). The pretest measures reduce residual variance in outcomes, increase precision of the impact estimate and can adjust for measured pretest difference at baseline, in the analysis sample, if necessary, and as required by WWC baseline equivalence standards when RCT attrition is high. The GSRT and researcher-developed measures, including teacher knowledge, will be administered on computers with the evaluation team proctoring the administration of assessments, minimizing missing data and rendering data cleaning and analysis efficient and accurate. Table 7 presents reliability data for each measure and links them to the corresponding research questions and analyses.

D.1.2.1. Student Measures. To address **RQ1 and RQ2**, students' reading comprehension will be assessed using three measures: (1) **GSRT** standardized multiple-choice test based on narrative texts, (2) state-level standardized test (**SLT**), and (3) three equivalent researcher-developed assessments will evaluate comprehension of expository texts. Specifically, proximal measures of Comparison Text Structure Signaling Word Knowledge (**CSW**), Comparison Main Idea Quality (**CMIQ**), and Problem and Solution Top-Level Structure Quality (**PTLSQ**) will be computed. These were validated in recent studies (e.g., [REDACTED]). For RQ3, students' reading motivation and self-efficacy will be measured using the reading self-concept scale from the Motivation to Read survey. The state-level test (**SLT**) will be z-scored (i.e., standardized) and pooled across states, so they are on a common measurement scale for use in the impact analysis as recommended by May et al., (2011).

Three Student ITSS fidelity measures will be calculated from the computer log files. 1) **ITSS-AVG** = average minutes per week, 2) **ITSS-TQC** = total number of questions answered

correctly in first or second attempt, and **3) ITSS-LCTS** = number of lessons completed in text structures (e.g., Comparison; Cause and Effect; Problem and Solution). As continuous variables, each can be included in the multi-level analysis model with student outcomes to assess their covariate-adjusted predictive relationship with student outcomes such as the GSRT and SLT.

D.1.2.2. Teacher measures administered online. To address RQ4, RQ5, the research team will use a web-based teacher knowledge assessment survey and classroom observations. Teacher knowledge of comprehension strategies will be measured before PD, after PD, and at the end of the academic year for each cohort. Treatment teachers will also answer questions related to any barriers or facilitators to using ITSS and KAT-360 (RQ6).

Teacher Observation Measure (RQ4 and RQ5). The Classroom Reading Observation app (Appendix J: Exhibit J3) will be used to measure adherence to the KAT six steps during teacher-led instruction. The measure has been validated by three experts and has inter-rater reliability of 98-99% (Hudson et al., 2021). Teacher KAT Use (TKU) = **Adherence** (# of KAT steps taught 0 to 6 points) - **Omissions** (i.e., Did not teach KAT “main idea,” “summary,” and “inference” 3 points) - **Contradictions** (i.e., Contradicted KAT approach while teaching “main idea,” “summary,” or “inferences 0 to 3 points). This App-based measure will be administered in all classrooms. The **TKUR** will be based on the scores from TAMURF and TRCC observations, and the **TKUS** will be based on the scores from the principals' and coaches' observations.

Table 7: Alignment of Measures, Analytical Roles, and Research Questions

Level	Type	Measure	Reliability	Role in Analysis	RQ
Student - Literacy	General Reading Comprehension	Gray Silent Reading Test (GSRT)	.83 - .94	Primary Outcome: HLM impact analysis (All Students)	1
	Administered fall (pre-) and spring (posttest)			Primary Outcome: HLM impact analysis (SPED Only)	2

				Primary Outcome: HLM prediction analysis (EMPOWER Only)	5
		State-level tests (SLT)	.88 - .96	Primary Outcome: HLM impact analysis (All Students)	1, 2
	Specific Comprehension Skills Administered fall (pre-) and spring (posttest)	Comparison Text Structure (CSW)	99%	Primary Outcome: HLM impact analysis (All Students)	1, 2
		Problem & Solution (PTLSQ)	99%	Primary Outcome: HLM impact analysis (All Students)	1, 2
		Comparison Main Idea (CMIQ)	99%	Primary Outcome: HLM impact analysis (All Students)	1, 2
Student - Affect	Motivation & Self-Concept	Motivation to Read Survey	.77 - .78	Primary Outcome: HLM impact analysis (All Students)	3
Student - Fidelity	ITSS Usage Metrics from Computer Log	ITSS-AVG, ITSS-TQC, ITSS-LCTS	N/A	Predictor/Moderator: HLM analysis for student outcomes	5
Teacher - Literacy	Teacher Knowledge & Practices Completed before & after PD & end of year	TKVC & TCMIA	.85	Outcome: HLM prediction analysis (EMPOWER Teachers)	4
				Predictor: HLM analysis for student outcomes	5
	Fidelity of Implementation Observed by school leaders (weekly) TAMURF and TRRC (twice)	Teacher KAT Use (TKUS & TKUR)	98%	Outcome: HLM prediction analysis (EMPOWER Teachers)	4
				Predictor/Moderator: HLM analysis for student outcomes	5

Data Analysis

The data to be analyzed will have the following empirical characteristics. First, the analysis samples will be free of confounds because of random assignment that will be conducted without compromise and consistent with WWC Standards Handbook 5.0, Table 7, p. 36. Second, they will be based on reliable and valid pre- and post-tests. Third, the analysis sample will be free of risk of bias due to high attrition (cluster or student) and thereby qualifying for the highest WWC rating of “meets standards without reservations.” Finally, it will be free of risk of bias due to joiners, as they will be excluded from the analysis sample.

Attrition will be assessed in the analysis sample for each outcome before adjustments for missing data (i.e., individuals with missing outcome data will be counted as attrition). We will calculate overall and differential attrition on the analytic sample for each outcome and determine whether attrition is considered low or high—at the cluster (schools) and sub-cluster (classroom and student) levels—using the WWC SRP 5.0 attrition boundaries. In case the attrition rate exceeds the WWC thresholds, we will assess the baseline equivalence of intervention and comparison groups on pretest scores of post-test measures in the analytic sample for the specific outcome, as required by WWC SRP 5.0.¹ All baseline characteristics that show effect size (i.e., Hedges' g for continuous variables) between 0.05 and 0.25 in absolute value will be included as covariates in all HLM analyses (i.e., statistical adjustment) to minimize bias in the impact estimates.

Missing pretest or post-test data, inevitable in even the best-planned and well-executed, field-based intervention research, will be handled by listwise deletion if the percentage of missing data is 5% or less if the missing pattern is completely at random (MCAR) or by multiple imputations if missing is at random (MAR). Both missing data methods are acceptable under WWC Standards 5.0. However, for multiple imputations, we will meet the additional WWC requirements of 1) imputation is conducted separately for intervention and comparison groups or includes an indicator variable for intervention status, 2) the same covariates used in the analysis model are used in the imputation model, and 3) the outcome is included in the imputation model if baseline data are imputed (WWC Handbook 5.0, p.97).

HLM Model Specifications: Addressing Primary and Secondary Research Questions

Hierarchical linear models (HLM) will be used to estimate the effect of EMPOWER on

¹ Both confirmatory outcomes have pre-intervention measures in the same domain as the outcome and therefore are sufficient for establishing baseline equivalence, according to WWC SRP 5.0. Same for exploratory outcomes.

the multiple student reading comprehension outcomes RQ1 (reading outcomes with all students) and RQ2 (reading outcomes with special education students)—because the data structure comprises students within classrooms, classrooms within schools, and schools are nested within sites that are defined as a group of demographically similar districts. Because of the modeling complexity attributed to four-level structures, we will initially test the degree to which sites differ on each outcome variable using an unconditional four-level model. Suppose the outcome variance at the site-level was not significantly different from 0 at the .05 alpha level. We will simplify the models to three levels. Otherwise, we will analyze four-level models, consistent with the statistical power analysis model for the random treatment effect model specified in reduced form as follows:

Equation 1

$$Y_{ijkl} = \delta_{0000} + \delta_{0010}(EMPOWER)_{kl} + \delta'_{1000}X_{ijkl} + \delta'_{0100}U_{jkl} + \delta_{0020}Z_{kl} + \delta_{0001}W_l + \delta_{2000}G \\ + \delta'_{1010}(EMPOWER)_{kl}X_{ijkl} + \delta'_{0110}(EMPOWER)_{kl}U_{jkl} + \delta'_{0021}(EMPOWER)_{kl}Z_{kl} \\ + \xi_{0jkl} + \eta_{00kl} + (EMPOWER)_{kl}\eta_{001l} + \varphi_{000l} + \varepsilon_{ijkl}$$

In this reduced-form equation, Y_{ijkl} represents the outcome for Student i in teacher j 's classroom, in school k , in district l . δ_{0000} is the overall mean and δ_{0010} represents the covariate-adjusted intent-to-treat (ITT) estimate for the EMPOWER intervention. $EMPOWER_{kl}$ is an indicator variable denoting the random assignment of a school k into the treatment or control group within district l . The model includes vectors of coefficients for vectors of covariates at the student ($\delta'_{1000}X_{ijkl}$), classroom ($\delta'_{0100}U_{jkl}$), and school ($\delta'_{0020}Z_{kl}$) levels. It also accounts for a district-level covariate W_l and a binary indicator grade indicator (G). The terms δ'_{1010} , δ'_{0110} , and δ'_{0021} and represent vectors of coefficients for the interaction between the EMPOWER intervention and covariates at the student, classroom, and school levels, respectively. The remaining terms are the error components at the classroom (ξ_{0jkl}), school (η_{00kl}), and district (φ_{000l}) levels, the student-level residual (ε_{ijkl}), and a

random-slope term $((EMPOWER)_{kl}\eta_{001l})$ to measure variability in the treatment effect across districts.

The vectors of covariates at the student, classroom, and school levels are defined as follows. At the student level, the predictor vector \mathbf{X}_{ijkl} includes student demographic variables (gender, special education status) and pretest scores (reading comprehension, motivation to read); demographic variables will be grand-mean centered, and pretest scores will be group-mean centered. At the classroom level, the predictor vector \mathbf{U}_{jkl} includes teacher experience, class-level comprehension pretest scores, and class-level motivation scores; teacher experience will be grand-mean centered, and class-level pretests will be group-mean-centered. At the school level, the predictor vector includes the percentage of students receiving free or reduced-price lunch and school-level pretest scores, which will be grand-mean centered.

In theory, the model is specified to examine the main effects of school and district characteristics as well as key interaction effects. At the school level, the model will account for school characteristics, such as the percent of students receiving reduced-price lunch and school-level pretest scores. At the district level, variables such as locale will be examined. The model is explicitly designed to explore potential cross-level interaction effects between the EMPOWER treatment and covariates (or moderators). This includes testing whether the treatment effect varies depending on student-level variables (e.g., initial reading level), classroom-level variables (e.g., teacher experience), and school-level characteristics by estimating the product terms between the treatment indicator and the respective covariate vectors.

In practice, this analytic framework will be systematically applied to answer each research question. For **RQ1** and **RQ3**, we will estimate the main effect of the intervention (δ_{0010}) on student reading comprehension (with standardized GSRT, SLT, and researcher-

developed measures) and affective outcomes, respectively. To address **RQ2**, we will apply the main model to test if the program's effect differs for special education students. If so, we will estimate the main model, but on the special education students only, to estimate the impact of EMPOWER on this specific group of students. Regarding the predictive questions involving EMPOWER schools and teachers only, **RQ4** will be addressed using a separate three-level model that uses teacher characteristics to predict their outcomes: “generate a main idea quality score” and their “reading instructional quality” (i.e., fidelity of KAT implementation scores e.g., TKUR). Finally, for **RQ5**, we will return to the student outcome model and include “generate a main idea quality score,” teacher fidelity of KAT implementation, and student ITSS fidelity as classroom-level predictors, along with an interaction term between them, to determine if their separate or synergistic effects predict student reading comprehension.

In addition, for **RQ1 - RQ3** we will estimate the effect size of EMPOWER compared to the business-as-usual comparison group for the outcomes. Precisely, we will compute the effect size as a standardized mean difference by dividing the adjusted (for pretest scores and other covariates) group mean difference by the unadjusted pooled within-group student-level standard deviation of the outcome measure (i.e., Hedges' g if standard deviations are similar for all treatment conditions) or by the comparison group student-level standard deviation (i.e., Glass' δ if standard deviations are very different, e.g., Lipsey & Wilson, 2001). Either way, we will translate the effect size to the improvement index so that educators can grasp the practical significance of the effect. The improvement index measures the average expected change in the percentile rank for an average comparison group student had they received the intervention (WWC 5.0, p. 186).

To conclude, although there are multiple outcomes in this study, it is not necessary to

apply any multiple comparison corrections such as the Benjamini-Hochberg adjustment (B-H; Benjamini & Hochberg, 1995) to control the false discovery rate in testing multiple hypotheses in the study for two reasons. First, the two confirmatory outcomes of standardized reading comprehension and motivation to read are each a single outcome in different domains. Second exploratory outcomes consisting primarily of the researcher-developed measures of reading comprehension skills do not require an adjustment because they aim to inform future research and do not serve as a replicable test of whether EMPOWER works. Finally, for a WWC review, the researcher developed measures of comprehension that are, by definition, in WWC SRP 5.0, supplemental findings and, as such, do not require a multiple comparison correction.

D.2. EMPOWER evaluation will provide guidance about effective strategies for replication.

The six research questions focus on the different aspects of the logic model from the EMPOWER component implementation to the intermediate outcomes of teacher knowledge and practices, with the intended outcome of improved reading comprehension outcomes for students. *The planned RCT will result in the highest quality causal conclusions about the impact effect sizes, and statistical significance.* The student outcomes from RQ1 and RQ2 will be the foundation of recommendations for replication. Correlations between the teacher fidelity and ITSS use to student outcomes will further provide guidance on which components and strategies are recommended for replication in other states and sites. All impact estimates will be analyzed to prepare structured adaptation recommendations and roadmaps to success from the EMPOWER project. To answer RQ6 related to expansion and how to address potential challenges to make replication and scale-up more successful and cost-effective, the research team will triangulate a variety of data sources, including survey and observation data from the app (e.g., TKUR), as well as data on the usage of the ITSS (e.g., ITSS-AVG, ITSS-TQC) and

KAT-360 systems (e.g., downloads of resources), and cost data. The research team will document the process from training to use and report on the context of the study to inform future use of the software, teacher resources, and school implementation.

Based on prior project experiences, anticipated challenges could include potential local adaptations or weakness with fidelity. We will document teacher questions and discussions during the KAT-PBPD to understand teacher concerns that could be addressed in future training or used to refine support materials. Finally, data from the online ITSS and KAT-360 systems will also be analyzed to identify potential challenges to implementation that could be addressed, thereby identifying components that make scale-up more successful. The TKUS local fidelity measure will make a valuable scale-up tool if found to be correlated with student outcomes.

D.3 EMPOWER Fidelity evaluation articulates the key project components, moderators, and outcomes, as well as a measurable threshold for acceptable implementation.

To answer RQ5 related to implementation fidelity, TRRC will collect data on each component of EMPOWER (depicted in the logic model): teacher PD including (1) *Initial 16 hours of training*; (2) *Use of KAT-360 resources*; (3) *in-class coaching*; (4) *Bi-Weekly PLC meetings*; (5) *Monthly KAT Chat*; and (6) *Quarterly benchmark reviews*, as well as the student components including (7) *Weekly ITSS use of 45 minutes*; (8) *Coverage of text structures* across ITSS lessons (must complete 5 lessons of each structure), and (9) ***Teacher fidelity*** observed by the school leaders and research team. Data sources related to the implementation of these components are: ***KAT 360 PBPD registration, lessons completed, and post-survey data*** used to measure teacher content knowledge and pedagogical skills. Scores of 0 to 4 on the Main Idea Competency for teachers will be considered low and 5-9 high. ***PLC*** will be used to generate participation in the planned 30 meetings. ***Teacher downloads from the KAT 360 Library will be counted.*** The ITSS system will calculate student time on ITSS, number of questions and text

structured completed for the total dosage. Most importantly, the **TKUS recorded by the school leaders on the i-Coach app** will serve as a key variable to correlate with student outcomes. This tool, approach, and results will inform recommendations for replication to other sites.

D.4. EMPOWER evaluation provides information to guide possible replication

The EMPOWER RCT *will estimate the impact of the components on student reading comprehension outcomes and guide possible replication of the four EMPOWER solutions*. The cost analysis will calculate the costs of the different components. The moderator analysis will deliver correlations between teacher knowledge, practices, and fidelity of implementation on student outcomes. The degree to which these results can be associated with different learner profiles (e.g., special education) and schools will help the team generate **Roadmaps to Success**. For example, based on the teacher's knowledge, observed classroom practices, and the school's textbook, we can note whether completion of the recommended KAT PBPD lesson path results in improved knowledge and teacher fidelity. If these metrics are correlated with student outcomes, then we will create a series of steps that can achieve 100% pass rates for students. The analysis will also report on special education students and any differences in the school outcomes by state.

We will validate these Roadmaps to Success with the Teacher Ambassadors, school leaders, and high-achieving teachers in the 72 participating schools. We will also survey teachers who did not have high-fidelity and inquire about potential solutions or changes that may help improve their delivery. The RCT results and all accompanying activities are designed to inform and guide possible replication of the EMPOWER components and strategies.

In summary, EMPOWER is designed to transform reading comprehension for 16,200 socioeconomically disadvantaged middle-grade students across five states.

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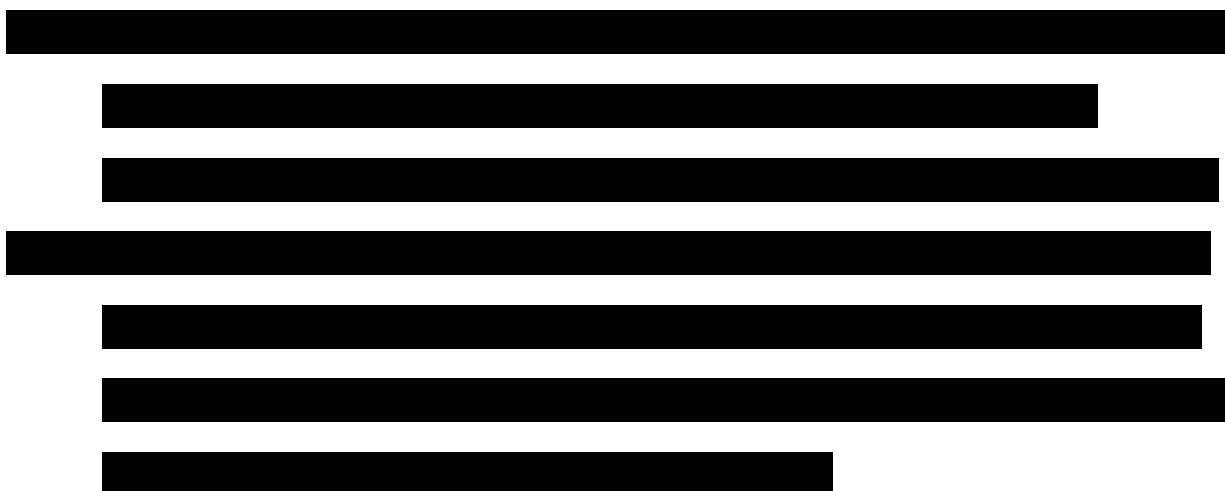
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